



## R & D STATUS REPORT

ARPA ORDER NO.: A476

PROGRAM CODE NO.: N00014

CONTRACTOR: Radiant Technologies, Inc.

CONTRACT NO.: N00014-93-C-0218 CONTRACT AMOUNT: \$475,754.00

EFFECTIVE DATE OF CONTRACT: 8/12/93

EXPIRATION DATE OF CONTRACT: 4/30/95

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SHORT TITLE OF WORK: Characterization of the Ferroelectric Imprinting Mechanism

REPORTING PERIOD 2/17/94 THROUGH 5/16/94

### DESCRIPTION OF PROGRESS:

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During this period all tests specified in the CORRELATE experiment matrix were completed. As noted in the previous quarterly report, tests in which the capacitors were driven with a fatigue waveform had to be repeated. This was accomplished, and the repeat data appears to be satisfactory. All the data has been analyzed for the interim CORRELATE test report, which is now being written.

The CORRELATE test was used to compare ferroelectric capacitor imprint rates measured by two test methods using eight different sets of test circuit and drive signal configurations. The purpose of this was twofold: first to reconcile disparate results obtained by different groups using various electrical tests, and second to determine a standard imprint test method to be used in the remainder of this contract. The test successfully defined the main elements of a practical imprint rate measurement technique, with some refinements still needed. This result is the first important step towards a standard reliability test of imprint for ferroelectric memory devices. These findings will be detailed in the interim CORRELATE report.

Good progress was made in May towards executing the remaining Category 1 tests: PASSIVATE, FATIGUE, and COMPOSITION. Significant delays were suffered in December through April, caused by lot processing problems described below. Use of the new DC-1A mask set for integrated

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capacitor production appears to have resolved these problems. With the process back on line and working as planned, the following Category 1 tasks were accomplished:

- (1) all wafers needed to supply die for the PASSIVATE, FATIGUE, and one of six COMPOSITION tests were diced,
- (2) 100 die with zero capacitor defects (no shorted or open devices) were screened using a millivolt pulse test and selected to be packaged for the FATIGUE test,
- (3) 50 die with zero capacitor defects were screened and selected to be packaged for the first COMPOSITION test,
- (4) ten die were trial packaged and tested to verify that the wire bonding process works and does not degrade capacitor performance,
- (5) lot MP2 was fabricated and tested for basic functionality, it passed for use in the second of six COMPOSITION tests,
- (6) lot MP3 was started for use in the third COMPOSITION test.

The remaining Category 1 tasks are on average eight weeks behind schedule. These tasks will be re-scheduled to be performed in parallel with the early Category 2 tasks. Also the remaining lot fabrication and testing can be accelerated. The projected slip in the completion of all contract tasks is now eight weeks.

For the Category 2 tasks, the targets for pulsed laser deposition were specified and ordered. The DC2 mask set generation is also nearly complete. Fabrication of Category 2 test lots can begin by the end of this month.

#### CHANGES IN KEY PERSONNEL:

No personnel changes were made.

#### SUBSTANTIVE INFORMATION FROM SPECIAL EVENTS:

None.

#### PROBLEMS ENCOUNTERED AND/OR ANTICIPATED:

As noted in the Description of Progress, problems causing delays were encountered in making packaged parts for the FATIGUE and COMPOSITION tests. These problems involved the top electrode and bonding pad metallization of the capacitor arrays. These metal lines were prone to two types of failure. The first was poor adhesion to the capacitor surface, causing the top electrode contacts to lift off the devices in the final process steps. The second was lifting of the bond pads when wire bonding for packaging was attempted. To stop these failures the fabrication steps were changed so that the top electrode metallization was applied over a glass passivation layer, with via contacts cut to the capacitor top surfaces. So far in packaging trials, this modified structure has shown good metal adhesion without the electrode or pad

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lifting failures found in the original design. This new design is incorporated in the wafer lots that are now being packaged for the FATIGUE and COMPOSITION tests.

Identification of the problem and development of the trial solution were both done quickly. The solution involved a design change that required a new mask set for applying metallization patterns to the wafers. The contract delay was caused by the time needed to design and generate this new mask set. It is anticipated that the remaining Category 1 tasks can now be accomplished in the time span originally planned for these tasks.

ACTION REQUIRED BY THE GOVERNMENT:

None.

FISCAL STATUS:

	<u>COST</u>	<u>FEE</u>
Amount currently provided on contract:	\$ 225,301.45	\$ 10,400.32
Expenditures and commitments to date:	250,799.00	12,072.96
Funds required to complete work:	207,707.00	5,175.04

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